



Flood - 101

Retrofit your well to reduce contamination

Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard



Floodwater can rise so high that it could flow back into your well through the top, where you usually remove your water. Floodwater can be very dirty after it picks up dirt and silt. It can also be contaminated from oil and other very harmful pollutants from garages, houses, cars, farms and factories. These pollutants make the well water unsafe to drink. The cost of purifying the contaminated water or finding another source of safe drinking water may be very high. Also, if the well collar is poorly installed, floating debris will have a greater chance of damaging the well. The photo to the left shows an example of an unprotected well underneath a home. Many wells today have protective collars; even with a collar, your well may not be safe. The gaskets could be cracked from dry rot or old age.

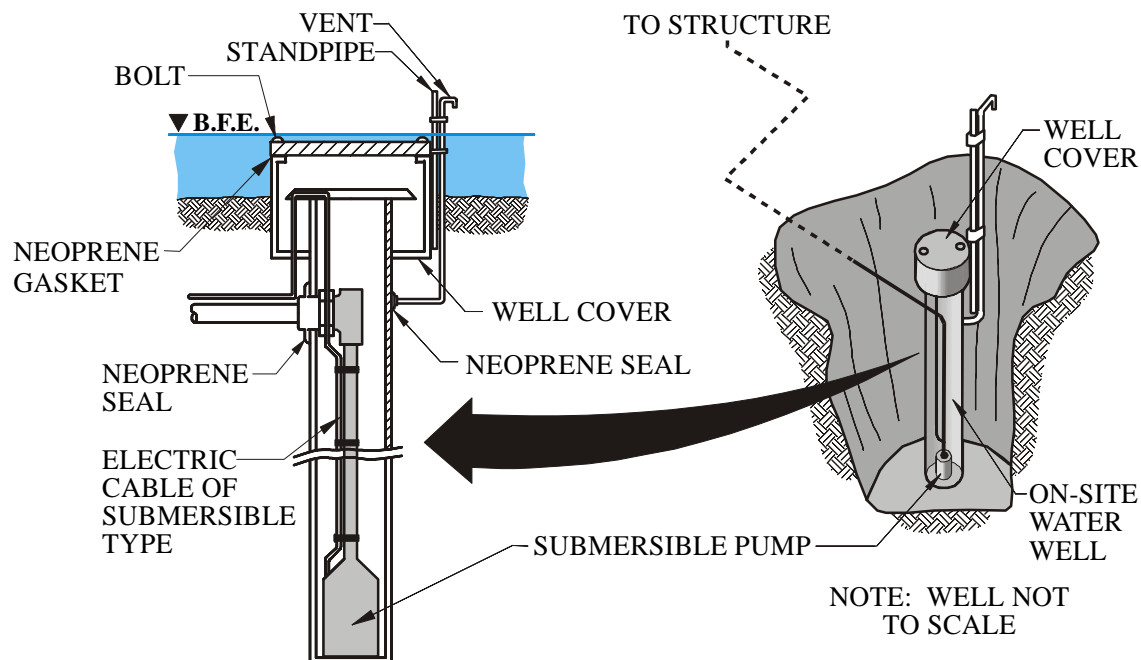
Mitigation Measure

To reduce the risks of floodwaters leaking into your well and contaminating its source, you can raise the protective collar around the well vault. The collar should be raised to 12" above the Base Flood Elevation. If this is impractical, you will have to rely upon a casing with a lid that has a gasket and bolts. A collar that you have to raise more than two and one half feet above ground level is impractical because it is too difficult to do any maintenance. If the floodwater velocity is low, there should be little chance of floating debris damaging the well casing. A properly installed casing with lid gaskets should keep any floodwater from getting in. See the photo of a gasketed well lid.



If the well lacks a protective collar, one should be installed. To do so, first dig around the well to a depth one-foot less than the collar length. For example, for a collar three feet in length, dig down two feet; then the collar's lid will stick up one-foot. Pour grout into the hole to a depth of about four inches. Push the collar into and through the grout so that the bottom of the collar is in soil. Fill the area around the outside of the collar with grout to ground level and let the grout harden. Make sure that the power supply chord and water piping coming out of the collar are gasketed at the interface with the collar – this will keep water from seeping into the collar. A certified plumber or well installer should be hired to do the work. The sketches shown here graphically depict the sort of assembly that should be sufficient to keep floodwaters from inundating your well.

If the well does have a collar, check whether the gaskets are cracked. This checking will require removing the lid cover. If the lid cover gasket needs replacing, you should also replace the other gaskets, too – if they are not cracked, they probably will be soon. A plumber or well installer should also complete this work.





Flood - 102

Maintain storm drains on your property

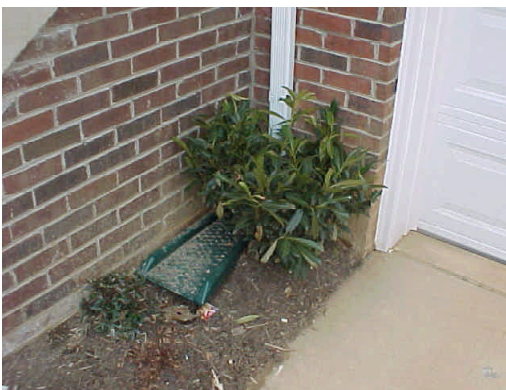
Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard

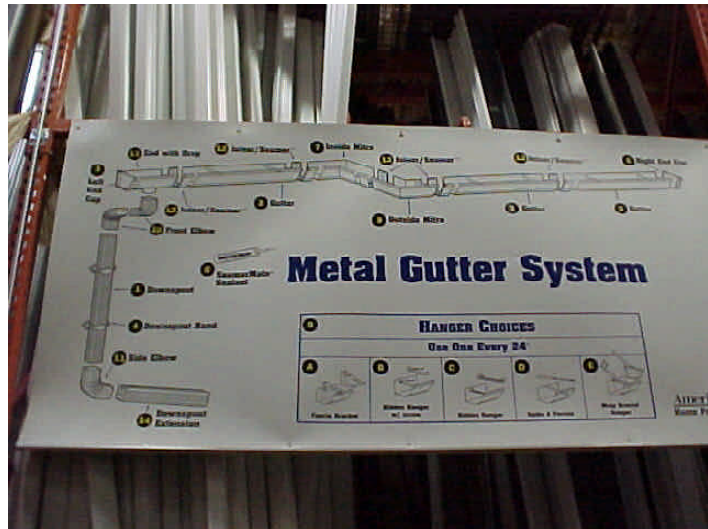
Most roads, paths and properties are sloped so flood and rainwater go to storm drains that collect and carry it away. If the water's path is blocked or the storm drain gets clogged, the water will take a long time to drain or may not be able to drain at all. Then the water collects until it gets high enough to flow another way. This new path could lead right into your home.



Water ponding against the side of your house could also damage its foundation. Saturation of the soil could cause the foundation to settle, and thereby weaken the structure above it.

Mitigation Measure

To reduce your chances of water damage to your home, you need to maintain the guttering, storm drains and flow paths on your property. During a severe rainstorm, leaves and other debris in your gutters may block rainwater from flowing away safely. You should remove debris as needed and leaves after the trees are bare so the water can move away from your home. Also, keeping the guttering downspouts and splash blocks in good condition will help to move unwanted water away from your home.



Gutter guard, a wire mesh with reinforced edges, can be placed over the guttering to keep out leaves that can cause blockages in the downspouts.



After the water has moved through the guttering to the ground, it must go across your property to the storm drains. Therefore, you need to keep the grading from your home and towards the drains clear. For example, you should remove or relocate large raised or built-up flowerbeds, piles of leaves and other garden materials that block or slow the flow of water



away from your home. Also, be sure to clear debris from drainage ditches or gullies regularly so they can carry the water to the storm drain. If there is an area where water ponds against the side of your home, that location may be a good place to plant flowers or shrubs and raise the earth to create drainage away from your home. You may be able to obtain fill dirt from other places on your property, your local government, or a landscaping company.



Flood - 103

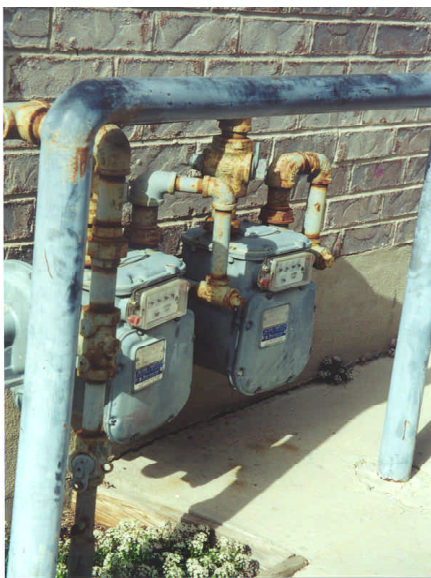
Install a gas safety cut-off valve

Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard

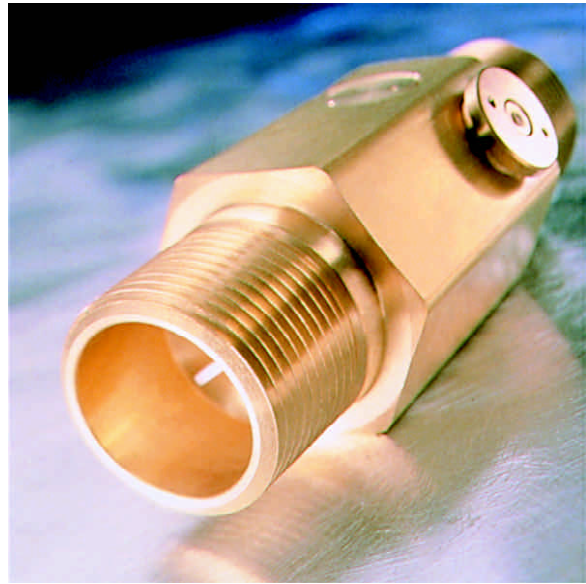


Floodwater often damage gas pipes. Gas pipes can be damaged from even minor floods when they crack or split, or when your appliances shake or are knocked over because your home shifts. Then natural or propane gas may escape into your house and create a serious threat of fire or an explosion. Injuries to you, your family, your home, your neighbors, and the environment may result.

Mitigation Measure

If you are replacing a portable kerosene heater or putting in bottled or tank based propane or natural gas heating systems, then a gas safety cut-off valve is an appropriate and good low-cost mitigation measure for reducing the risks of a gas leak into your home. One such device is

the Sanders Safety Cut-Off Valve, which is installed on your gas pipe outside the home. The Sanders Valve has been approved by the American Gas Association. This self-contained, one-inch valve fits on the low-pressure side of the regulator leading to a gas pipe. Its spring stops the flow of gas whenever there is a break in the pipe or a drop in gas pressure, which may happen when there is an accident or natural disaster. Because the valve is placed in-line above ground, it is easy to determine if a home already has one installed. One needs only to find the gas meter or propane tank and see if the valve is in line near to the meter or the tank.



Installing the valve has many benefits to you. It shuts off the gas flow at the first sign of a gas pipe break or pressure drop, and the valve remains closed until inspection and repairs have been completed. Thus it removes the danger of gas escaping into your home and causing a fire or explosion. The valve does not require any special attention from you because it automatically resets after repairs have been made. Also, it is weather resistant and does not require any power to operate, so it is very cost-effective. Because it is adaptable to a wide range of situations, it can be installed without any digging on your property.



Besides providing protection during a flood, the cut-off valve also provides protection for pipes that could be damaged during an earthquake.

To assemble, install, or service the Sanders Safety Cut-Off Valve, a state-certified plumbing and heating technician or gas utility technician will be required. It should be noted that the valve will work for high or low pressure systems and is easily set.



Flood - 104

Anchor and elevate fuel tanks & AC units

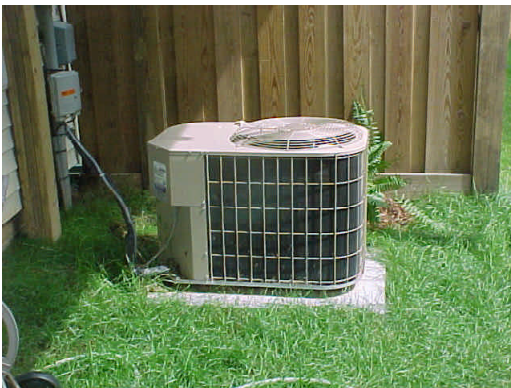
Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard

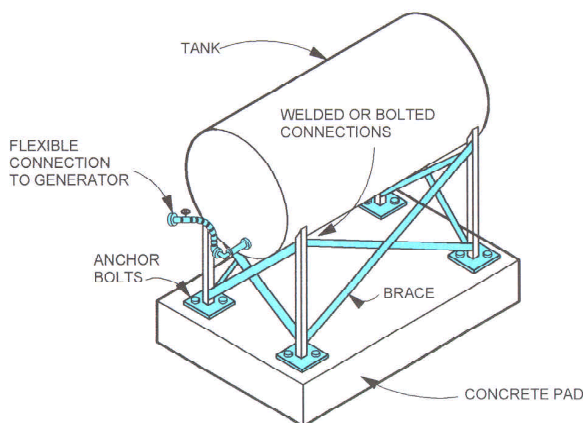
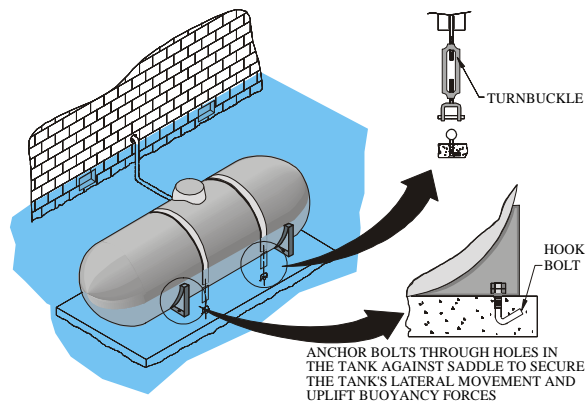
Floodwaters can easily move unanchored fuel tanks, which then may tip over or float. Escaping fuel may result in spills and fires. These tanks pose serious threats not only to you, your family, and your house, but also to public safety and the environment.



An unanchored tank outside your house can smash into your walls and be swept downstream, where it can damage other houses. Even a buried tank can be pushed to the surface by the buoyant effect of soil saturated by water. When floodwaters move an unanchored tank in your basement, the supply line can tear free, and contaminate your basement with oil.

Mitigation Measure

There are several ways to anchor your fuel tank. A method that can be used for any tank, whether it is inside or outside your house, is to attach it to a large concrete slab whose weight is great enough to resist the buoyant and lateral forces of floodwaters. You can anchor an outside tank by running straps over it and attaching them to ground anchors. Use fasteners made of non-corrosive metal like stainless steel or galvanized metal. The structural supports can also be of non-corrosive metal or pressure treated wood. You should also elevate the vent tube above the base elevation. The type of anchorage needed depends on the tank's size and size and stability of the structure it is being attached to.



Whether your tank is indoors or outdoors, keeping it topped off will increase its weight and thereby reduce its tendency to float. If you have adequate warning of a hurricane or other major rain event, ask your fuel company to top off your fuel tank. If your home lies in a flood-prone area and your tank is in the basement, it is especially important to top it off.

To protect an air conditioning compressor or heat pump, elevate it and its service lines to at least a 12" safety margin above the base flood elevation (BFE), including all filling and ventilation tubes. Use a base of masonry, concrete, or pressure treated lumber. If your air conditioner or heat pump is outside, install it securely on a platform above your flood protection level.



Flood - 105

Anchor your home

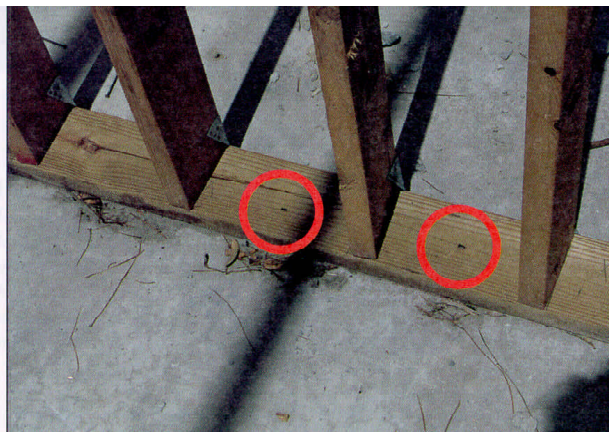
Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard

If your home is not adequately anchored to its foundation, it may float away in high floodwaters. Your home may also be pushed from its foundation by the pressure of floodwaters against a sidewall. Houses with wood framing and lightweight covering materials that float are at great risk.



Manufactured homes have additional hazards. They are often anchored to the ground with large pins, called ground anchors. They pull out of water-soaked ground far more easily than from dry ground. A floating or moving home also becomes a hazard that can cause great damage to other structures.

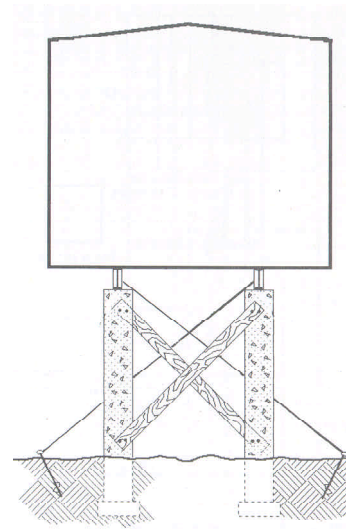
Mitigation Measure

The best protection from these problems is to secure your house to the ground or to a heavy concrete foundation.

A typical single family home should be secured to its foundation through its wooden sill or base plate with half-inch diameter anchor bolts spaced at four feet or less and in sufficient embedment.



Manufactured homes can be secured in several ways. To determine your best securing strategy, you must have site-specific flood information. You can secure the base directly to the ground or use ties (rust-resistant straps or cables) that go over the top of your home. The ties are held into the ground by anchors whose embedded length and type are determined by your type of soil. See *Manufactured Home Installation in Flood Hazard Areas*, FEMA Publication 85, for more information.



A manufactured home elevated on piers, piles, blocks, stub walls or wood should be braced and anchored appropriately, considering the possibility of soil saturation and soil type. There are two common methods of bracing or securing a manufactured home. Knee bracing can be wood crosspieces or wire straps attached to the horizontal beam supporting the home. Diagonal bracing uses wood or steel rods and provides even greater stability.

A manufactured home that is elevated on fill material, such as soil, and is on flat land where expected floodwater speeds are low may not require additional securing.





Flood - 106

Apply protective sealant to your walls

Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard

Many homes are flooded by shallow floodwaters. Floodwater even less than two feet deep can severely damage your home if it comes inside. Repairing damage to your walls and floors can be expensive, and you may not be able to live in your home while the work is being done.

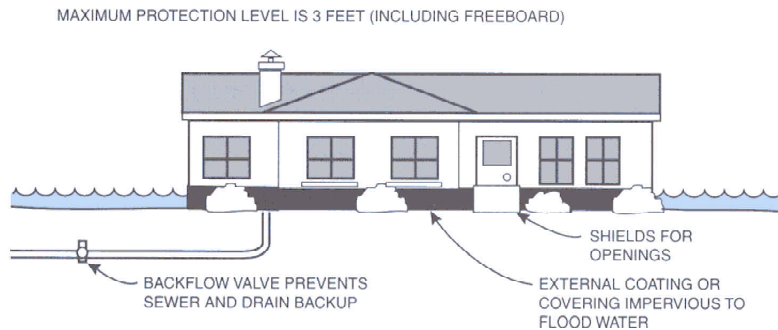


Mitigation Measure

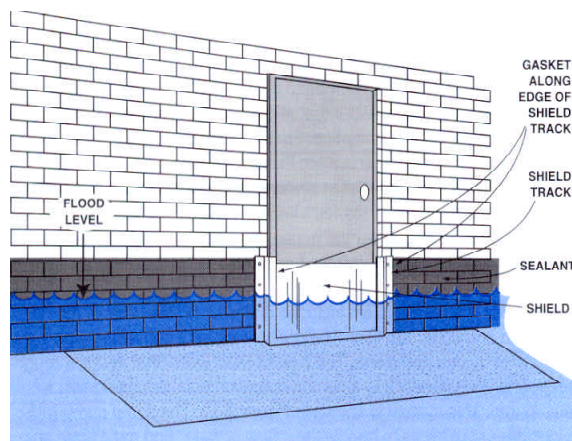
For many homes, it is not economically feasible to raise the entire home one-foot above the Base Flood Elevation (BFE).

Therefore, you need to waterproof your home. One way to do so is to put protective sealants on your walls. To protect your house from shallow flooding, put a waterproof veneer on its exterior walls and seal all openings, including doorways. This method should be used only for

homes that have flood depths less than three feet and should not be used on manufactured homes. The sealant application should not extend higher than one foot above BFE. This limitation is important because typical masonry or frame walls usually require additional bracing or strengthening if they have more than three feet of pressure from still water.



A sealant mitigation measure can be a veneer or layer of brick backed by waterproof sheeting. Before applying the veneer, remove the siding and replace it with exterior grade plywood sheathing. If necessary, extend the existing foundation footing to support the brick. Also, because the veneer will be exposed to floodwater, you might need to make changes to the interior walls so they will resist moisture damage if water gets through the protective coating. In the area below the flood level, replace standard batt insulation with washable closed-cell foam insulation. Use exterior grade lumber for any wood blocking added inside the wall cavity.



All openings, both windows and doorways, need to be flood-proofed, too. You can waterproof doorways and low windows with a removable shield made of either metal or wood. Install a special gasketed sill in the bottom of doorways to ensure a waterproof seal. Bolt the door shield to the frame of the doorway against a gasketed mounting strip. Similarly, mount the window shield against a gasketed window-mounting strip to a height of one foot above the BFE.

Notes:



Flood - 107

Install a septic backflow preventer

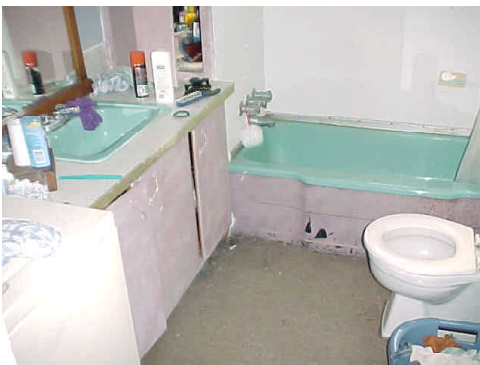
Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard

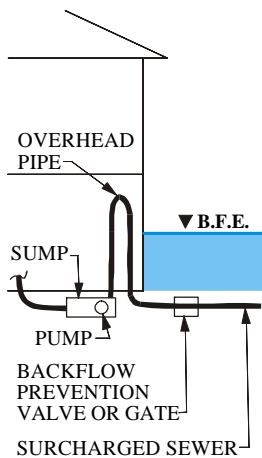
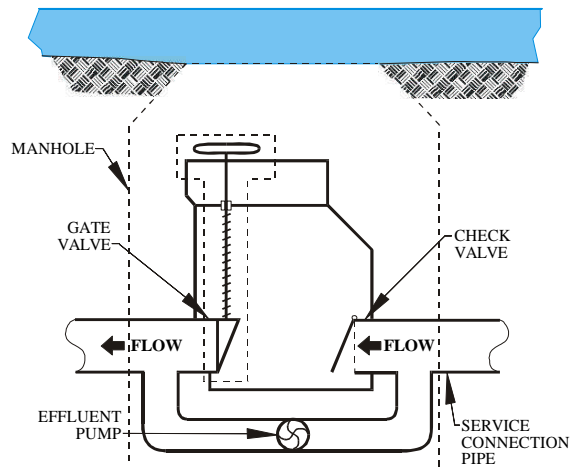
When people think of their home flooding, they usually picture floodwaters coming through windows, doorways, and leaky walls. Another way floodwater can enter the home is through gravity drains, such as septic lines and sump drains. A back up of sanitary sewer lines, which brings sewage into your home, creates an unhealthy situation. Repairing the damage may be expensive, and you may not be able to live there until repairs are made.



Mitigation Measure

A good way to protect your home from sewage backups is to install backflow valves, which are

designed to block drainpipes temporarily and prevent flow into your home. Valves should be installed on all pipes that leave the home or are connected to equipment that is below the potential flood level. Therefore, valves may be needed on washing machine drain lines, laundry sinks, fuel oil lines, and sump pumps, as well as sewer/septic connections. Sump pumps are included because they may be connected to an underground drain line and, as a result, may require excavation before installing a valve.



Backflow valves are available in a variety of designs that range from the simple to the complex. The figure shows a gate valve, one of the more complex designs. It provides a strong seal, but must be operated by hand; therefore, its effectiveness depends on how much advance warning you have of the flooding. Among the simpler valves are flap or check valves, which open to allow flow out of the home but close when the flow reverses. These valves operate automatically but do not provide as strong a seal as a gate valve. Sump drains can be protected in a similar fashion. Some valves incorporate the advantages of both flap and gate valves into a single design.

If you are connected to a municipal sewer system you may consider installing a backflow valve. There have been instances where the municipal sewer system has been surcharged causing flooding in homes that are above the base flood elevation.

Changes to the plumbing in your home should be done by a licensed plumber or contractor, who will ensure that the work is done correctly and according to all applicable codes. This is important for your safety.

Notes:



Flood - 108

Consider wetproofing options

Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazards

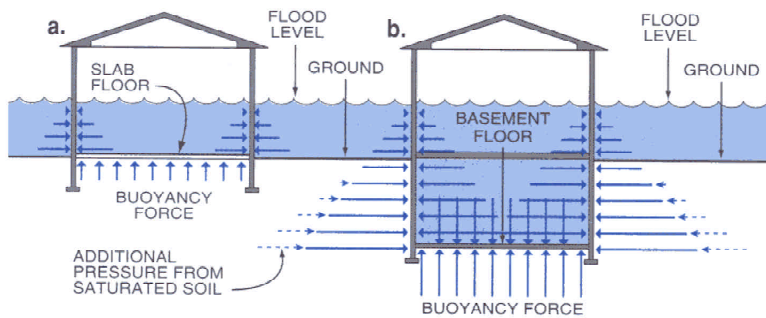
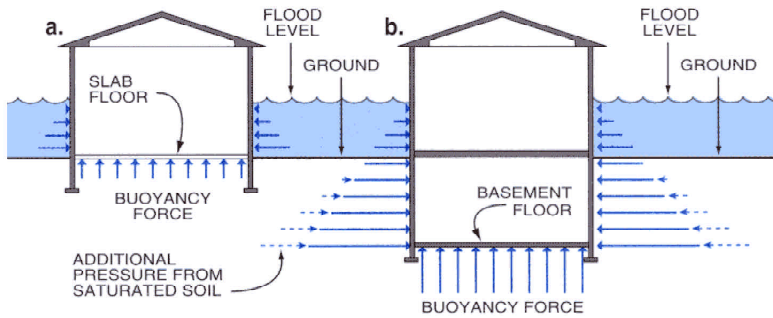
There is a danger to homes if floodwaters are kept out during extended periods of severe flooding. If the walls are not strong enough to resist the pressure, the water could collapse them and destroy the home. This risk is especially strong if the floodwater regularly rises three feet or more. Another potential risk is that if the home is too watertight, it will become buoyant, pull away from the ground anchors or foundation, and float away.



A secondary hazard is that the floodwaters continuously deposit debris and potentially contaminated silt and mud which create health risks. The presence of the silt and mud makes cleanup more difficult and causes moisture to persist. The moisture can create further damage to your home after the floodwaters have receded because mold and mildew thrive in a damp environment. As a result, you may not be able to live in your home for a long time and could have to replace materials that are not water-damaged.

Mitigation Measure

Wet floodproofing is the term for measures taken to protect one's home from these hazards. Wet floodproofing allows the house to flood and avoid structural damage. It uses flood resistant materials and the relocation of appliances and equipment to minimize damage and speed recovery. One measure you can take is to ensure that there is adequate venting so that water moves freely under your home. The venting also helps the crawlspace dry after the floodwater has receded. Any bracing added to the walls should not block these openings.



To protect against damage from long-term standing water inside your home, you can install a floating drain plug in the lowest floor of your home. This solution is most appropriate for manufactured homes. However, any home with a crawl space underneath could

benefit from having floating plugs in the lowest floor. If you let water into your home, the pressures are equalized inside and out so your home does not become buoyant.

As floodwaters recede, the floating drain plug allows water to escape. As the water drains out through the plug, much of the silt and mud may also exit. Your home will still be very dirty; however, with the plug strategically located and easily accessible, your cleanup should be easier.

Another measure is to utilize flood resistant materials below the base flood elevation. These materials will resist damage due to flooding and will not need to be replaced when the flooding recedes. In conjunction with flood resistant materials you should consider relocating appliances and utilities above the base flood elevation.

See FEMA 312 "Homeowners Guide to Retrofitting" and <http://www.fema.gov/mit/rfit>.



Flood - 109

Install interior or exterior flood walls

Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard

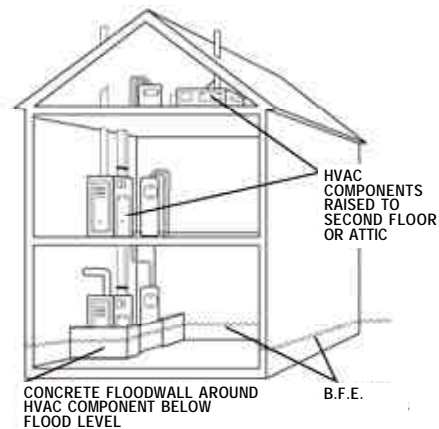
Nuisance or marginal flooding one to two feet deep affects some areas, usually those near the edge of the floodplain. In these areas, anything in the basement, particularly electric appliances, is at risk from water damage. Appliances that are in water for even short periods will probably have to be replaced. Another serious problem is the risk of fires caused by short circuits in flooded systems. Also, cleaning up and making repairs without having electricity are even more difficult.



Mitigation Measure

Flood barriers can protect your property. They work best where flooding is less than three feet deep. First, decide whether to have the flood barriers on the outside of your home or around critical appliances inside your home.

An interior floodwall can protect your home against low levels of flooding. It must be constructed of either concrete blocks or poured concrete and reinforced with steel rods to resist the pressure of the floodwaters. Anchor the new wall into the existing basement wall and floor so floodwaters will not move it. It should be built to one foot higher than the Base Flood Elevation (BFE) but no higher than three feet (for strength reasons). To protect against seepage through the floodwall or basement wall, install a sump pump with a floating switch. The pump's outflow hose should drain the water over the edge of the floodwall. An alternative to an interior floodwall is to relocate utilities to a upper floor above the base flood elevation.

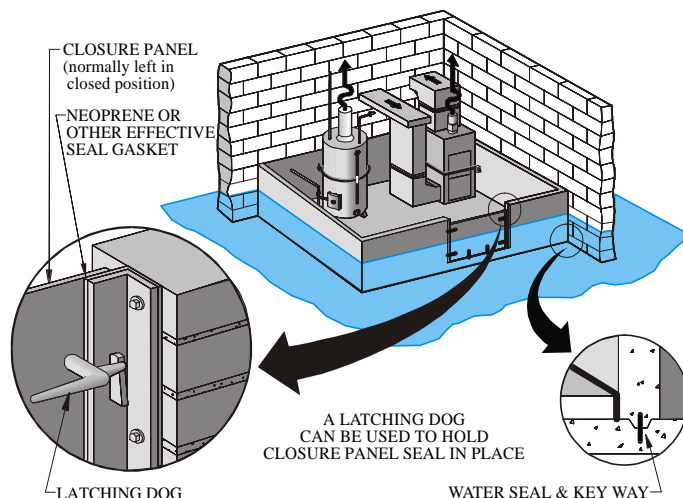


Exterior floodwalls, prevent floodwaters from reaching your home. Floodwalls, usually built of concrete, must be at least one foot above the BFE. Outside berms are small levees, usually built from fill dirt, around window wells or other openings through which flood waters may enter the structure. For best protection, do not install gates that open into the enclosure. It is important to properly evaluate the likely flood conditions and your soil conditions.

Floodwalls, berms, and levees can either surround the building (ring levee) or connect to high ground. They can also be built up against a building's foundation walls. Pumping out water that seeps under the walls will require a sump pump. Similarly, an exterior floodwall constructed of masonry or properly reinforced poured concrete can protect a window well or stairway against low-level flash flooding. In this case, only individual portals are protected because prolonged flooding is not expected. Walls should be supported by and securely tied to a

footing so that they will not be undercut by scouring. Once again, the wall should not be higher than three feet.

See FEMA Publication 348, *Protecting Building Utilities From Flood Damage*.





Flood - 110

Relocate or elevate internal appliances

Flooding is the most frequently occurring disaster in the United States. Most damage comes from river or ocean flooding, but it can also result from the flooding of small streams or creeks that rise quickly.

Flooding normally occurs in the same places. This predictability means you can focus on reducing damage there. You should do as much as possible to prevent and reduce your damage, inconvenience, and costs by using mitigation opportunities. Now is the best time to floodproof your home and buy insurance under the National Flood Insurance Program.



Potential Hazard

Nuisance or marginal flooding affects some areas of the country, usually those at the edge of the base flood elevation (BFE). If the area has floods of no more than one or two feet, it



may not be cost effective to raise your home to avoid future floods. Anything in your basement is at risk to water damage, especially an appliance that depends on electricity. If it is in water for even a short time, it will probably have to be replaced. Another serious problem is the potential for fires caused by short circuits in flooded electrical systems. In addition, after a flood, cleaning up and making repairs without having electricity are made more difficult.

Mitigation Measure

If only your basement floods regularly, it is easier to relocate or elevate appliances and critical utilities than to raise your home. Typical basement appliances and utilities include clothes washers and dryers, hot water heaters, furnaces, and electric fuse boxes. If your basement has baseboard heaters, those heating units also need to be elevated.

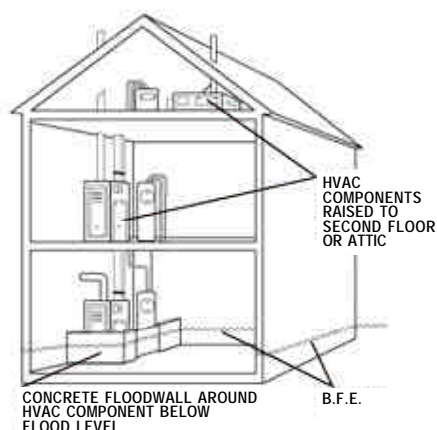
Appliances and utilities can be easily elevated a short distance. Remember to elevate them to at least a one-foot safety margin above the highest known flood level or the Base Flood Elevation (BFE). For low heights, use concrete blocks or a platform made from pressure treated lumber and supported by concrete blocks. Make certain that washers and dryers are secure and will not vibrate off the blocks or platform during use—securely fasten them with straps to the wall or floor. If you have flooding greater than two or three feet, putting these items on the next higher floor may be the best solution since there is limited headspace in the basement.



The best way to protect your valuable electrical system is to keep it from getting wet. All components of the electrical system, including the wiring, should be raised at least one foot above the BFE. Electrical work of this sort may require removing some interior wall sheathing (drywall, for example). It is a good idea to run the wires overhead. If a wire has to run into the areas where it could get wet, use a wire rated for underground use. No wire should end in the flood zone, and all junctions should be located in approved junction boxes.

In homes at high flood risk, protect the heating, ventilating, and cooling equipment by moving it from the basement or lower level of the home to an upper floor or attic. A water heater can

be put anywhere near a hot water pipe. If the existing ductwork for your furnace is below the BFE (e.g., on a slab or in a crawlspace beneath the home), relocate it so it distributes heat from above and runs free and clear of floodwaters. You can replace an updraft furnace in the basement with a downdraft furnace on a floor above the flood protection level .



See FEM A Publication 348, *Protecting Building Utilities From Flood Damage*.

Unit 3: Recognize the Risks and Mitigation Measures

Notes	Flood Exercise Sheet
Assess Flood Risks	Participants look at pictures of potential risks and identify the appropriate mitigation measures by putting the corresponding numbers from the Action Checklist on the answer sheet.

Flood Answer Sheet	
Picture Number	Action Checklist Number
1	
2	
3	
4	
5	
6	
7	
8	
9	

Verify Mastery	Discuss responses.
----------------	--------------------

Unit 3: Recognize the Risks and Mitigation Measures

Flood Risk Pictures

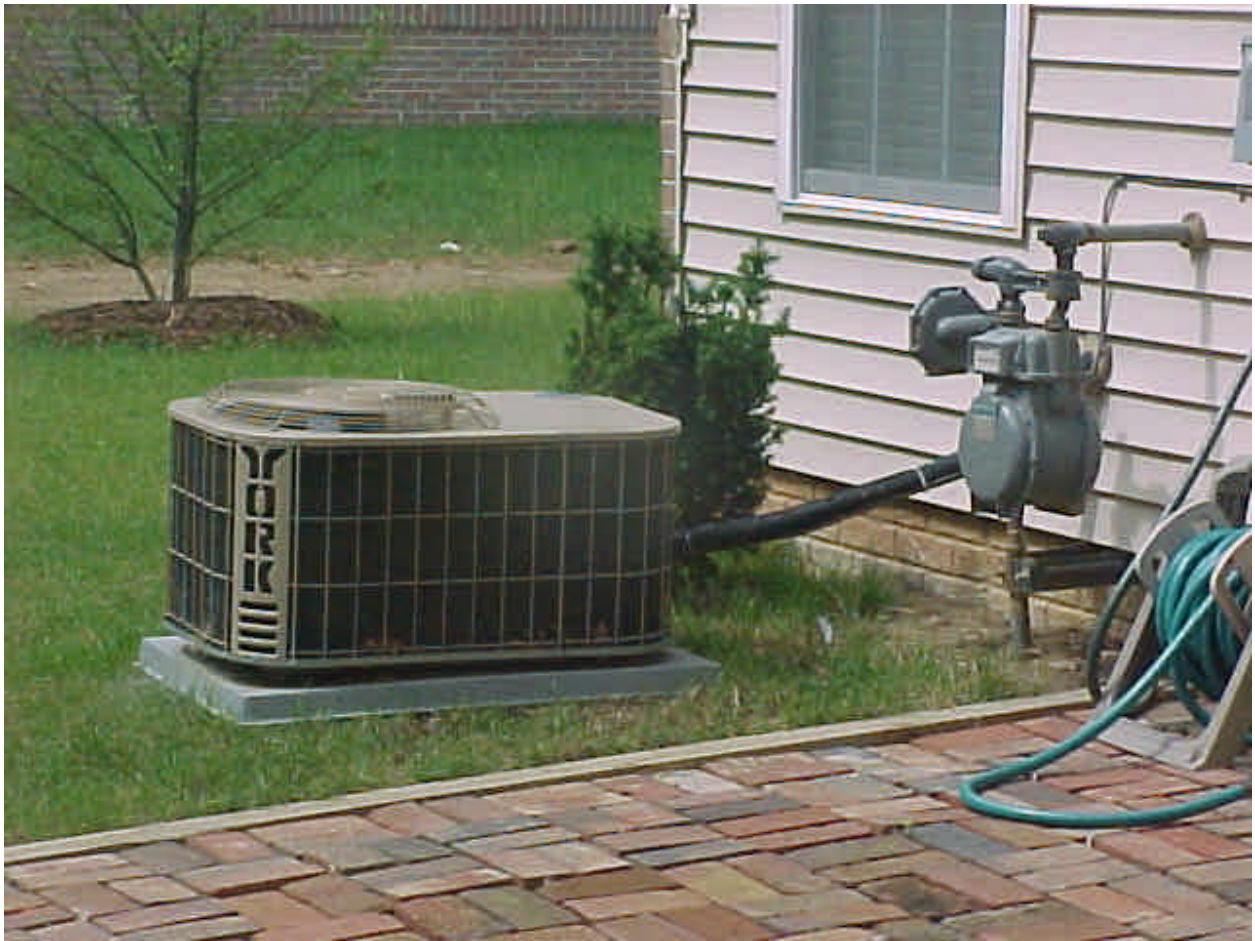
(See following 9 pages)

Flood Risk No. 1



Scenario – Base Flood Elevation 1 foot above existing ground

Flood Risk No. 2



Scenario – Base Flood Elevation at ground level

Flood Risk No. 3



Scenario – Base Flood Elevation 3 feet above ground level

Flood Risk No. 4



Scenario – Base Flood Elevation at ground level

Flood Risk No. 5



Scenario – Base Flood Elevation 3 feet above ground level

Flood Risk No. 6



Scenario – Base Flood Elevation for this well housing is 1 foot above ground level

Flood Risk No. 7



Scenario – Base Flood Elevation at ground level

Flood Risk No. 8



Scenario – Base Flood Elevation at ground level

Flood Risk No. 9



Scenario – Base Flood Elevation 1 foot above ground level

Unit 3: Recognize the Risks and Mitigation Measures

	Flood Exercise Sheet Answer Key
	The answers below are only possible, not definite. Encourage participants to identify potential hidden risks that may not necessarily be visible in the photo.

Flood Answer Sheet	
Picture Number	Action Checklist Number
1	103, 104, 105, (would consider 107 if BFE was higher; never wetproof a manufactured home)
2	104, 106, 107 (would consider 105 and 109 if BFE was higher)
3	105, 107, 108
4	102
5	105, 108 (never apply protective sealants to crawlspaces)
6	101, 109
7	102
8	103, 104, 106, 107, 109 (would consider 105 if BFE was higher)
9	103, 106, 108, 109, 110